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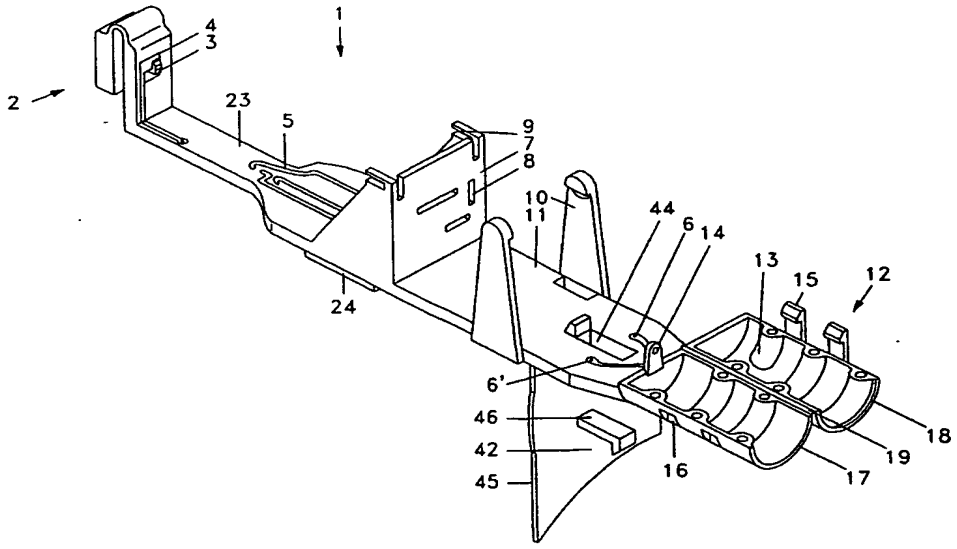

(57) Abstract

The invention concerns a holder for the use in a refrigeration appliance, the holder being made of pressure moulded synthetic plastic resin. To simplify the mounting of thermostat housing, lamp socket, switches etc., metallised or metallisable conductors arranged in or on the surface of the holder are used. This causes a considerable simplification of the mounting. Further, the holder has a high degree of integration, as lamp socket, thermostat housing holder, door switch, mirror and connector are moulded into the same holder. The invention also concerns a method for the production of the holder.

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Holder for use in a refrigeration appliance and method for the production of such a holder

The invention concerns an injection moulded plastic holder for use in a refrigeration appliance.

A holder for a refrigeration appliance is typically arranged inside a lamp housing in the refrigeration or freezing compartment of the appliance. The lamp housing comprises an outer front, often provided with a transparent glass or plastic window, behind which a lamp for the illumination of the inside of the refrigeration appliance is placed. Inside the lamp housing a number of lamp housing units are arranged, for example, holder, lamp, switches, timer, potentiometer, mirror, plug connection or thermostat. In special cases lamp housing and holder are identical, but in the following it is assumed that the holder is a separate unit, on which the electrical or electromechanical units (lamp, switches, potentiometers or thermostat) are mounted.

When the refrigeration appliance manufacturer (Original Equipment Manufacturer, OEM) assembles his refrigeration appliance, the lamp housing is not a finished unit, but has to be assembled first, and often the lamp housing units are of different makes. By manual work, these units must be fixed mechanically on the holder and connected electrically by means of cables. Electrical connections are established both between the individual lamp housing units and out of the housing, for example to the compressor, and the cables are - as a cost increasing and time consuming necessity - typically terminated by means of flat pin terminals and flat sockets. During the assembly, the large number of cables and intermediary cables arranged in a small space often involves the risk of incor-

rect cable connections. At a later stage of the life of the refrigeration appliance, new human interference with the lamp housing may occur, for example when the thermostat is damaged and needs replacing.

It is therefore desirable to make a holder for a refrigeration appliance, which causes that the human handling of the lamp housing units in connection with the mechanical fixing and electrical connection is reduced to a minimum. The state of the art describes a solution to this task in US 5,002,492. This document describes a holder for a refrigeration appliance, in which holder a lamp socket is integrated, an integrated electrical connection from lamp socket to holder being created ex works. Thus, manual cabling between holder and lamp socket is not required. The electrical connection is made by means of a thin, conducting sheet, for example made of copper, inserted in parallel with and between two plastic plates. The lamp socket is moulded into one of the plastic plates. Thus, the holder is made as a sandwich construction, and by means of snap connections a thermostat housing can be mounted direct on the holder. The snap connections are made by moulding the plastic plates with holes laying open the intermediary, electrically conduction sheet. The sheet is made with punched holes with resilient projections, in which the thermostat with terminals is inserted. Additionally, a brightness control can be arranged on the holder. The mounting process is substantially simplified by this integration of electrical and electromechanical devices on the holder, and both space and costs are saved as well, as the normal cabling can be avoided. However, the production method described involves considerable costs, and the snap solution with sheet has several disadvantages. The relatively thin sheet is primarily meant for creating the electrical contact to the conductors integrated in the holder, but it does not provide sufficient mechanical

fixation. Additional fixing by means of screws or the like will be required. Further, it is questionable, how good the electrical contact between thermostat terminal and the resilient projection is, as, eventually, the thin sheet will not be able to maintain the required contact pressure. The weak contact pressure will also cause oxidation of the contact surface, a consequence of which could be an interrupted connection.

Compared with the demands on mass-produced units the sandwich construction of the holder is too time consuming and expensive, as the production involves several punching and folding operations as well as assembly and sealing of the three components of the holder.

The task to be solved with the present invention is to simplify the production process of a holder, the electrical conductors being integrated in or built together with the holder, and at the same time to improve and simplify both the mechanical and electrical connection between the holder and the electrical and electromechanical devices mounted thereon.

This task is solved as described in the characterising part of claim 1, the holder consisting of one piece of synthetic plastic resin with electrically conducting strips inside or on the outside of the holder, the holder being equipped with one or more snap connections for electrical or mechanical mounting of the electrical or electromechanical devices.

In relation to the state of the art, the solution involves the major advantage that a holder with integrated conductors for a refrigeration appliance can now be mass produced in a plastic moulding line, and when it leaves the line it is finished. Additional assembly and sealing of

several elements of the holder are not required, and the holder can be finished in a few steps. A preferred, known production process is a two-component or three-component plastic moulding, the holder being made of one kind of plastic, the electrically conducting strips being made of a different kind of plastic, which is metallised and electrically conducting or metallisable and accessible to an electrically conducting coating. The strips can be arranged on all sides of the holder with the opportunity of through-plating as known from common printed circuit board techniques. Additionally, it involves the improvement that both on production of the refrigeration appliance and on replacement of defective contact units the mounting is substantially simplified.

The use of metallised or metallisable plastic is known under the name Moulded Interconnect Devices (MID), the plastic surfaces being metallised to protect, among other things, the electronic circuits from electromagnetic interference. From the automotive industry, it is also known to use metallised plastic for mirrors and reflectors. From this field, it is known to use polycarbonates as preferred thermoplastic material. For example, US 5,503,934 describes a metallising process.

EP 0 637 044 describes a rotary switch assembly made in a two-component moulding process, the injection-moulded plastic strips being plated with a copper coating during a plating process. Additionally, the document describes the use of metallised plastic in a lamp socket, in a connector, and as conductors and change-over points in the switch. The rotary switch assembly is produced and definitively assembled in the factory, and cannot be repaired if a fault occurs. This is contrary to the holder of the invention, which is produced under consideration of its being easy to handle and to mount, both at the OEM and

later, in the home of the user, when a defective unit must be replaced.

The use of metallised or metallisable plastic for the production of a holder additionally involves the advantage that both the mechanical and the electrical contact can be improved. Claims 2 and 3 describe how a snap connection can be made so that at the same time it ensures good mechanical and electrical contact. This is done by using a plastic with a softer resilience for the resilient element than that used for the holder. Using plastic for the production of the snap function also causes that the resilience can be controlled very accurately during production by means of stoichiometric parameters, and the resilience can be made so hard that the mechanical fixing becomes so good that additional fixing by means of screws etc. is not required. The snap or the click can be made by forming a bead on the movable arm of the snap connection, so that the bead can engage in a similar recess in the terminal of the mounted lamp housing unit.

Advantageously, the snap connections can adopt a thermostatic housing, as described in claim 4. The typical thermostatic housing for a refrigeration appliance has a rectangular volume with flat terminals on one side, and the holder with snap connections according to the invention will then at the same time fix the thermostat mechanically and create the electrical connection through the holder to the compressor. The delimited surface for reception of the thermostatic housing may be provided with several sets of snap holes, so that one set fits one type of thermostat, another set fits another thermostat etc. These thermostats may be variants from one manufacturer or thermostats from different manufacturers. Thus, the holder can be made universally applicable and contribute to an

additional reduction of production costs due to larger numbers.

From US 5,002,492 it is known to integrate the lamp socket in the holder. Here, the electrical connection is created via two flaps of the electrically conducting sheet, the flaps being placed at the bottom and at the side of the socket. The contact flaps are not large, and have the disadvantage, that exactly the fact that they are flaps makes them fragile and bendable. Additionally, their placing in the socket requires a particularly accurate positioning. Making the holder as described in claim 5 will do away with additional positioning work, and provide a reliable electrical connection. The thread in the lamp socket and the contact area in the bottom are made of a conducting or metallisable material of the same type as the material used for the electrically conducting strips on the holder. Besides the threaded mounting, the socket can have different types of mountings, for example of the pinol type. In connection with the production it has proved advantageous for the socket or the lamp socket to comprise two halves, which can be assembled to one socket. This is described in claim 6. Thus, the embodiment of the plastic moulding tool can be substantially simplified.

Claims 7, 8 and 9 describe an embodiment, in which an electrical switch is integrated in the holder, which switch is produced in the same process as the holder. The switch breaks or makes at a mechanical action, and is typically a door contact. The electrical switch material is the same as the material for the electrically conducting strips, and in the embodiment in question the switch is shaped as a U, one leg of the U being the movable part.

Besides conduction of electrical current, metallised plastic can, as commonly known, also be used for mirrors

and reflectors. The holder can also be provided with a plate arranged at the lamp socket, the plate having a metal coating which makes it serve as a mirror. This is the basis of claim 10.

Claim 11 describes an embodiment, in which a connector is moulded into the holder. Both electrical contact surfaces and surrounding connector surfaces are made of the same material and during the same process as the rest of the holder.

Claim 12 concerns the fully integrated solution, in which most of the lamp housing components are integrated in the holder.

To avoid short-circuiting as a consequence of condensation, claim 13 suggests to make channels in the surface of the holder between the electrically conducting strips.

Claim 14 describes the preferred thermo-plastics of which the holder can be made.

Different techniques can be used for the production of the holder, but the method described in claim 15 is assumed to be the best. Using a known poly-component moulding technique, the holder can be made of a first plastic type, and the conductor strips of another one. To simplify the subsequent mounting of holder and holder components, as many components as possible should be incorporated in the holder, which is possible to a large extent by using snap and locking functions, which are moulded at the same time as the holder. Moulding recesses or material weaknesses into the holder will provide folding lines or hinges, around which the plastic can be bent or restrained so that mechanical or electromechanical functions occur.

Based on the following figures, the invention will be described in detail:

Fig. 1	an embodiment of the holder according to the invention
Fig. 2	the connector of the holder
Fig. 2a	a section of the connector
Fig. 3a,3b,3c	a snap connection sequence
Fig. 4	snap functions in the holder
Fig. 5a,5b	a snap function in detail
Fig. 6a,6b,6c,6d	an embodiment of the electrical switch of the holder
Fig. 7	another embodiment of the electrical switch of the holder

Fig. 1 shows the holder 1 with electrically conducting strips 5, 6, 6' applied on the surfaces 11 and 23. If desired, the strips can be applied on both sides of the holder. Integrated in the holder is a U-shaped contact or switch 2, meant for detecting when the door of the refrigeration appliance is opened, so that the light is turned on. The contact functions in that one leg of the U is equipped with a perpendicular arm 3, which is in contact with a contact surface 4 on the other leg of the U. The contact areas are made of the same material and during the same process as the surface conductors 6, 6' and 5. Figs. 6a to 6d show the contact in detail, Fig. 6d showing the shape it has after the injection moulding. A material weakness or a recess 37 describes a folding line, around which the head 38 can be bent, so that the arm 3 with barb engages with the basis 39 through the window 41. Inside the basis 39 and the head 38 as well as the arm 3 and the barb 43 is arranged a conductor 42, which is brought in contact with the contact surface 4 arranged on the opposite side of the basis 39. When the arm is locked in the

window 41, the contact is made, and a pressure on head 38 will cause the contact to break. Fig. 7 shows a variant of the contact described, in which there is no arm. Here, the making and breaking takes place inside the U, and the contact works with a making function at mechanical action. When selecting metallised or metallisable conductor, it must be considered that the conductor is sufficiently flexible and can stand mechanical movement, which is the case in the curve of the U.

At the opposite end of the holder, and integrated in the holder is a lamp socket 12 with a thread, the thread being provided with a metallic layer 13, which gives a good electrical ground connection for the bulb. The conducting layer 13 is connected with the conductor 6. At the bottom of the socket there is also a contact area 14, which provides supply voltage to the bulb via the conductor 6'. The socket is divided in two halves or half shells 17 and 18, which are assembled to a whole via a hinge 19 by means of the snap connections 15 and 16. The division of the socket in two is made to simplify the production of the plastic moulding die. After assembly of the holder by the refrigeration appliance manufacturer, the two parts are snapped together, and the bulb is mounted.

On the bottom side 26 of the holder is a connector 24, which is moulded together with the holder, see Fig. 2. This also applies for the electrical connections 25, which are made of conducting plastic or metallisable plastic with a metal coating. Fig. 2a shows a section of the connector 24, which is made as a female plug with a conducting surface 29 inside the connections 25. One advantage is the opportunity of providing conductor strips through the holder from the side 23 to the bottom side 26, as shown in the lead-through point 30. The connector can be male or female and be made in many ways, and in this

embodiment it is the interface to the rest of the refrigeration appliance. The current to the compressor passes through this connector, and the starting current may be 4 to 5 times the operating current. In a small refrigerator this corresponds to 25 A, which the conductors of the holder must be able to stand. One typical example is conductor strips, 5 mm wide and 1 mm thick. When designing the course of the conductor strips on the holder, voltage flashovers and the risk of creation of "whiskers", that is the formation of thin short-circuiting threads between the electrically conducting strips, which do not only occur with traditional printed circuit board techniques but also with plastic techniques, must be taken into consideration. This is done by providing good distances between the conducting strips or by making safety ditches between the strips, either as channels direct in the holder surface 11 between the conductors 6 and 6' or by injection moulding of the conducting strips elevated in relation to the surface 11. These latter solutions are particularly relevant in a refrigeration appliance environment, where condensate often occurs, which could lead to short-circuits.

The thermostat housing is placed with its terminal side towards the delimited surface 7, which has holes 8 for the reception of the terminals. Flexible supporting arms 10 provide an additional fixing of the thermostat housing. The holes 8 lead into a snap device of the same kind as position 9, which again is shown in a section in Figs. 3a, 3b and 3c. These figures show the snap sequence, which is finished in Fig. 3c. Fig. 3a shows the snap connection in a passive state, in which the softer, flexible arm 20 with the bead 21 bears on the more rigid arm 22. By means of a poly-component moulding, the flexible arm 20 can be made of a softer plastic material than the surface 7 and the opposite arm 22, or in the bending area the arm can be

made thinner, for example by means of a recess, so that the material is weakened in relation to the rest of the holder. Conducting plastic or metallisable plastic, which is subsequently metallised, can be led along the opposite side to the surface 7 and onto the arm 20, and if required also over the bead 21, so that a contact surface occurs on the inside of the arm. This is shown in Figs. 5a and 5b and in Fig. 4. The conducting strip 32 is led up along the bracket 31 to the opposite side of the surface 7, and then onto the arm 35. Here, the rigid arms 33 and 34 are not coated with a conducting layer, but if required, they can be. Fig. 4 shows a vertical conducting strip in position 36. With this technique, it is possible also to lead conducting strips across bent surfaces, as can be seen with the lamp socket 12. Alternatively, the side opposite to the surface 7 can be coated with a sheet with conducting strips, which sheet is then melted into the plastic surface at a high temperature. This technique is known under the name of Hot Foil Stamping. Fig. 3a also shows the thermostat housing 27 and one of the terminals 28. Fig. 3b shows the deflection of the arm 20 as a consequence of the entry of the terminal, and Fig. 3c shows the finished snap sequence, as now the bead 21 rests in a corresponding hole in the flat terminal spear 28 of the thermostat. The snap solution gives a very good mechanical fixing without requiring the use of screws or the like, as the bead does not permit any horizontal movements of the thermostat housing, and at the same time the electrical connection is secured without the use of cables or soldering, which would make the construction more expensive. Another component, which could be fixed on the holder by means of a snap function, could be, for example, a temperature display.

Fig. 1 shows a plate 41, arranged under the holder and the lamp, and serving as a mirror. The plate is covered with a

reflecting metal layer 42 and can be tipped up under the lamp, so that the mirror lies in extension of the holder. An arm 43 with barb engages the hollow space 44 in the holder. The mirror serves the purpose of directing the light from the lamp in a certain direction, and can be connected with the holder through a hinge connection, which enables turning, clicking or forcing the mirror into its place in the lamp housing.

The holder with mounted conducting strips and integrated electrical and electromechanical lamp housing units can be mass produced by means of various known techniques. Previously, two-component or three-component moulding has been mentioned, in which a platable plastic is embedded in a non-platable plastic, the platable material being subsequently coated with a metal. The injection moulding is made by using conventionally manufactured dies at temperatures between 200 and 400 degrees centigrade. The coating with metal can be made during a subsequent chemical process, in which the injection-moulded component is, for example, submerged in or sprinkled by a metal ion saturated plating liquid. For example, "polyamide 12" can be used as non-platable material, and glass reinforced "polyamide 6" as platable material. Other possible metallisable plastics are, for example, acrylic nitrile butadiene styrene (ABS), liquid crystal polymers (LCP), polyethylene (PE), polypropylene (PP) and styrene acrylic nitrile (SAN). The glass reinforcement in polyamide y causes that the metal sticks to the glass fibres. Another possible technique is to use conducting plastic, which contains metal particles for conducting the current. One example of such a plastic is polyphenylene oxide (PPO). However, conducting plastic is not a good conductor under all circumstances, and the adhesion can be a problem. On the other hand, this is made good by a quick production proc-

ess when using two-component moulding without subsequent metallising of the component.

These two techniques are particularly applicable in connection with the lightly complicated geometries of the snap function and the lamp socket. Additionally, the techniques enable the fitting of electrical resistors in the conducting strips. This is done in that in selected spots in the conducting strips a third plastic is injection moulded in stead of the used conductor, which plastic either has a larger electrical resistance, or which can only be plated with a metal having a larger electrical resistance. In special cases the integration of electrical resistors can be used to reduce voltages to security voltages.

Further, Laser Imaging can be used to create electrically conducting strips, the injection moulded holder being completely coated by a conducting metallic layer, which is then removed by the laser in the areas, where electrically conducting strips are not needed. Also the previously mentioned Hot Foil technique can be used, as well as can the traditional Insert Injection Moulding, during which traditional metal inserts are placed in the die to be embedded in plastic. Also the coating of the plastic component with a thick-film will be possible.

Patent Claims

1. Holder for use in a refrigeration appliance, the holder being meant for carrying one or several electrical or electromechanical devices, such as thermostat, lamp, contact, timer or potentiometer, these devices being connected with the refrigeration appliance through electrical conductors built together with the holder, **characterised in** that the holder (1) is manufactured as a one-piece unit in synthetic plastic resin with electrically conducting strips (5, 6, 6') arranged in or on the surface (11, 23) of the holder, the holder being equipped with one or several snap connections (3, 8, 9, 10, 15, 16) for electrical or mechanical mounting of the electrical or electromechanical devices.

2. Holder according to claim 1, **characterised in** that a snap connection (9) has an electrical and mechanical function and is made with a resilient contact area (20), the resilience being obtained by moulding into the contact area a softer plastic different from that of the holder (7, 22), or by weakening the plastic used for the holder and then metallising the resilient or stationary range, so that a contact surface is formed.

3. Holder according to claim 2, **characterised in** that the snap connection (9) has a resilient arm (20, 35) made of the other, softer plastic, and a fixed arm (22, 33) made of the plastic used for the holder, an electrically conducting strip (32) being arranged on the resilient arm, and the resilient arm having a bead (21)

for obtaining the snap effect.

4. Holder according to claim 3, **characterised in** that the holder has a delimited surface (7) for mounting of a thermostat housing, this surface containing snap connections (8, 9) for the electrical terminals (28) of the thermostat housing.

5. Holder according to claim 1, **characterised in** that the holder is equipped with a lamp socket (12) made of and integrated in the material of the holder, the electrical connection of the lamp socket being effected via the electrically conducting strips (6, 6'), which are led into the lamp socket.

6. Holder according to claim 5, **characterised in** that the lamp socket comprises two halves (17, 18), which are connected via a hinge (19), one half having a projection (15) with a barb, the other half having a room (16) for reception of the projection with the barb.

7. Holder according to claim 1, **characterised in** that the holder is equipped with an electrical switch (2), consisting of and integrated in the material of the holder, the electrical contact material (4, 42) being of the same material as the electrically conducting strips (5, 6, 6').

8. Holder according to claim 7, **characterised in** that the switch is substantially U-shaped and acts upon a mechanical pressure on one leg of the U.

9. Holder according to claim 8, **characterised in** that the switch comprises a basic part (39), a recess (37) and a head (38), the head having an arm (3) with a barb

(43) meant for engagement with the basic part (39) via a window (41), the arm and the barb being coated with a first electrical conductor (42) being connectable to another electrical conductor (4) via the arm and the barb.

10. Holder according to claim 1, **characterised in** that the holder is equipped with a plate (45), which is completely or partly connected with the holder, and preferentially positionable via a hinge connection between holder and plate, the plate being coated with a reflecting material (42), mainly the material also used for the electrically conducting strips.

11. Holder according to any of the preceding claims, **characterised in** that a connector (24) of the male or female type is moulded into the holder, the electrical contact areas (25 in the connector being made of the same material as the electrically conducting strips.

12. Holder according to claim 1, **characterised in** that as an assembled, integrated unit the holder comprises a switch (2), a surface (7) for the reception of terminals (28) from a thermostat housing, a lamp socket (12) a connector (24) and a plate with mirror surface.

13. Holder according to claim 1, **characterised in** that the electrically conducting strips (6, 6') are separated from each other by channels made in the surface (11) of the holder, or that the strips are elevated in relation to said surface.

14. Holder according to any of the preceding claims, **characterised in** that the holder is made of a first thermoplastic material, for example, polyester carbon-

ate (PC) or polyamide 6, and the electrical conductors are made of a different thermoplastic material, for example acrylic nitrile butadiene styrene (ABS) or polyamide 12.

15. Method for the production of a plastic holder for a refrigeration appliance, using injection moulding in the production process, **characterised in** that the holder is moulded by using at least two plastics, one being used as basic substratum of the holder, the other for electrical conductors, mechanical, electrical and electromechanical functions being moulded onto the holder, these functions mainly being realised by means of snap functions, locking functions and well-defined folding lines on the holder.

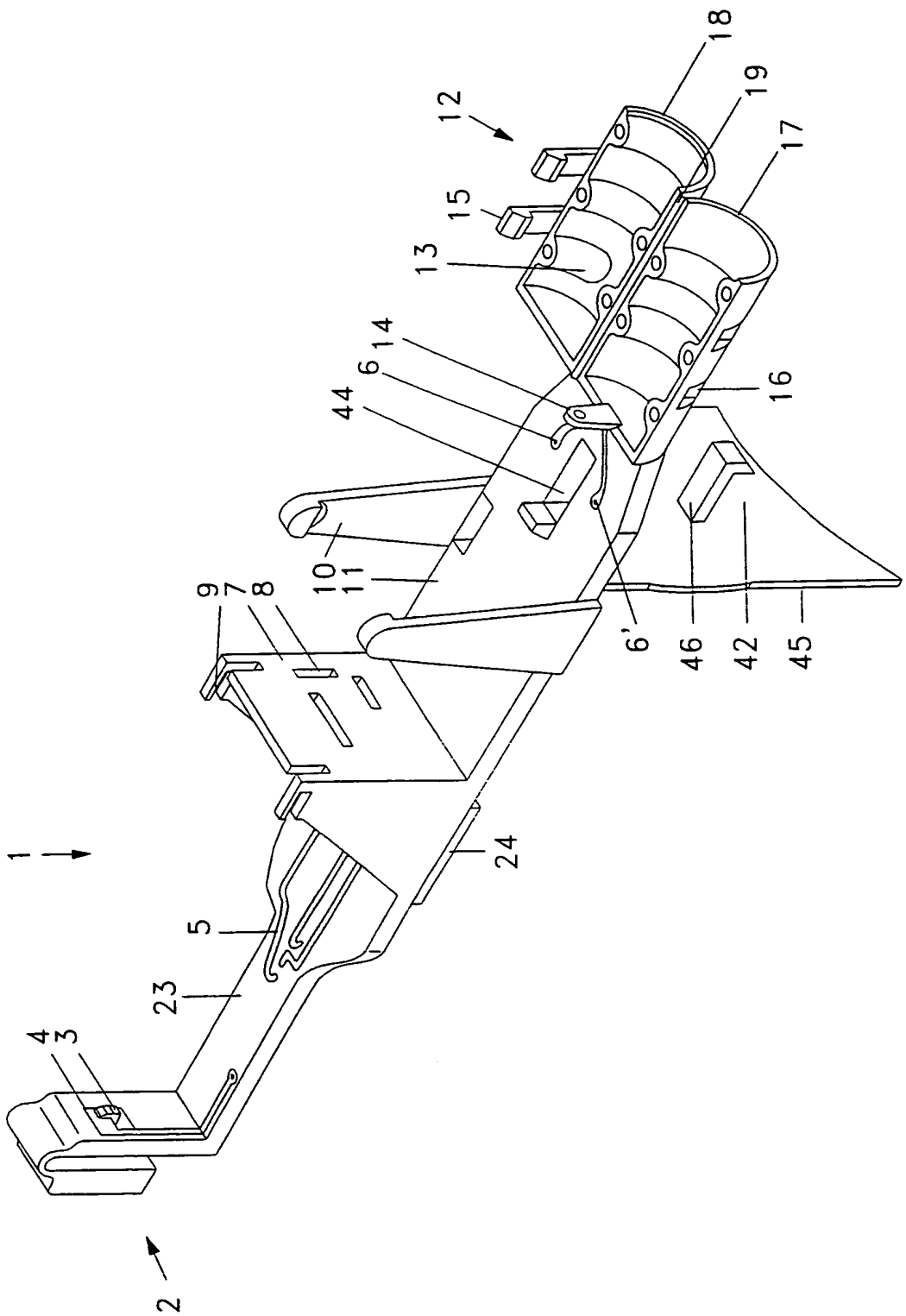

Fig. 1

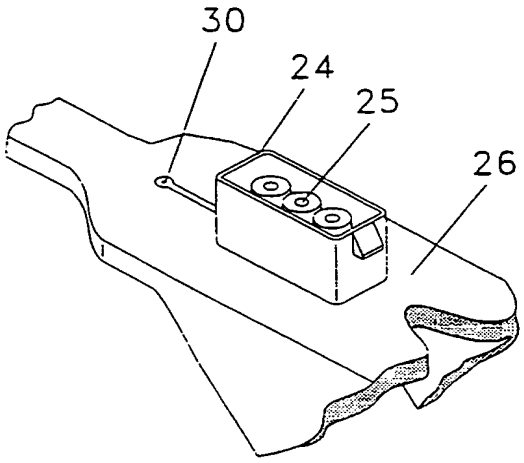

Fig. 2

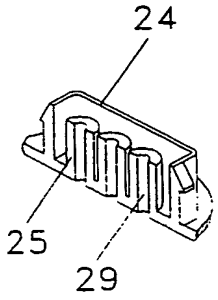

Fig. 2a

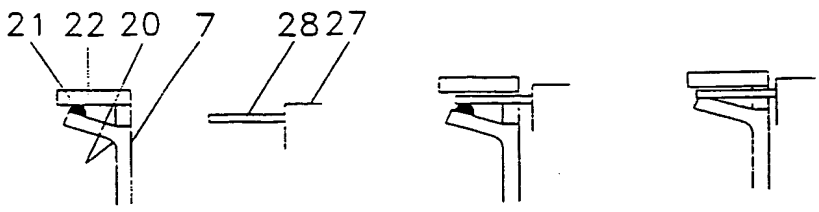

Fig. 3a Fig. 3b Fig. 3c

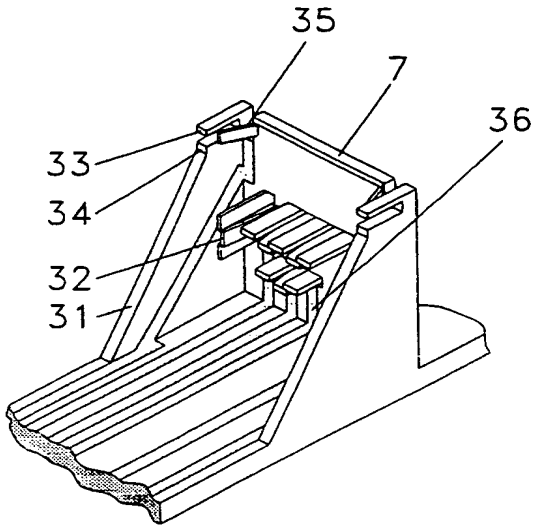

Fig. 4

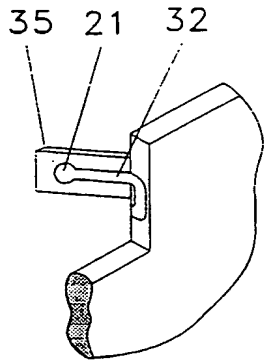

Fig. 5a

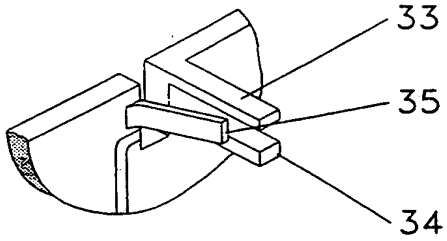

Fig. 5b

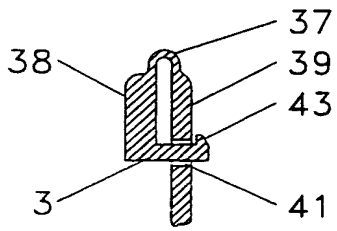

Fig. 6a

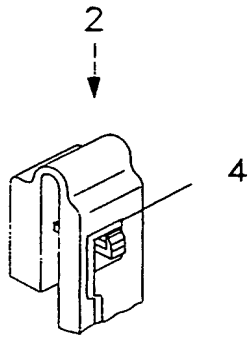

Fig. 6b

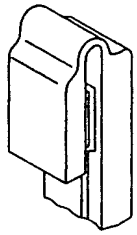

Fig. 6c

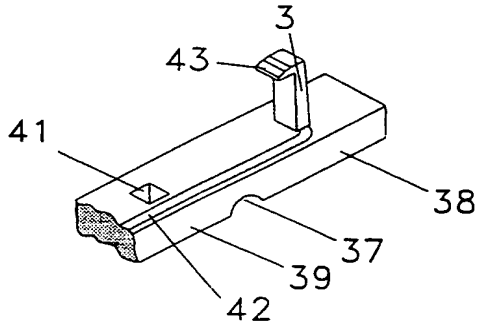

Fig. 6d

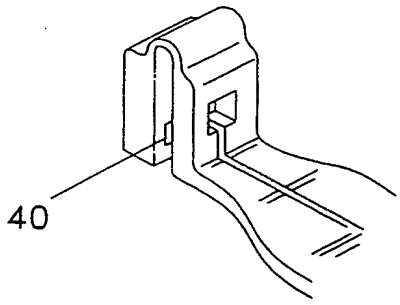

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 99/00265

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F25D 27/00, F21V 23/00, H05K 3/20, H01R 33/20
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: F25D, F21V, H05K, H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5002492 A (BASSI), 26 March 1991 (26.03.91), column 2, line 25 - column 4, line 54, figures 1,2	1,15
A	US 5529535 A (FORISH), 25 June 1996 (25.06.96)	1-15
A	GB 1585463 A (AMP INCORPORATED), 4 March 1981 (04.03.81)	1-15
A	GB 1030283 A (THOMAS JOHN ROWLANDS ET AL), 18 May 1966 (18.05.66)	1-15

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search
15 Sept 1999

Date of mailing of the international search report
12 -10- 1999

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INTERNATIONAL SEARCH REPORT

Information on patent family members

30/08/99

International application No.
PCT/DK 99/00265

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5002492 A	26/03/91	DE 3934785 A	31/05/90
		GB 2225495 A,B	30/05/90
		IT 214985 Z	30/07/90
		SE 8903409 A	19/04/90
US 5529535 A	25/06/96	NONE	
GB 1585463 A	04/03/81	AU 510497 B	26/06/80
		AU 2718377 A	25/01/79
		BE 857674 A	10/02/78
		BR 7705431 A	23/05/78
		CA 1086414 A	23/09/80
		DE 2736245 A	23/02/78
		FR 2362504 A,B	17/03/78
		IT 1081632 B	21/05/85
		JP 53024592 A	07/03/78
		NL 7708120 A	21/02/78
		SE 417567 B,C	23/03/81
		SE 7709284 A	19/02/78
		US 4208080 A	17/06/80
GB 1030283 A	18/05/66	NONE	